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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

COUNTRY USSR (Estonia)

DATE DISTR. 16-FEB-54

SUBJECT Notes on the Oil Shale Industry/Carbonization Plants/Mine and Plant Production Figures/Mining Methods/Use of Shale in Locomotives

NO. OF PAGES 7

PLACE ACQUIRED

NO. OF ENCLS. (LISTED BELOW)

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SUPPLEMENT TO REPORT NO.

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THIS IS UNEVALUATED INFORMATION

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in its early stages the new plant of Ahtme was often referred to as "Johvi," although it is actually located about four miles south of Johvi as indicated on map "B" Johvi became an administrative center for the entire industry as well as an essential power interconnection point, but I seriously doubt the existence of an oil carbonization installation at this location. There is no natural or technological justification for having a new plant at this site. The situation might be different concerning another new oil shale plant not mentioned Untna-Kabala. According to the first publication of the USSR five-year plan of 1945 a new carbonization plant was to be erected here with an annual output of 190,000 metric tons or about 1.2 million barrels crude oil. The assumed location of this plant is not unfavorable concerning shale seams and other natural resources.

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Concerning the three large plants of Kohtla-Jarve, Ahtme and Kivioli and the two small ones of Sillamae and Kohtla (oldfields) See sketches "K" through "L" which illustrate the main carbonization units of the various systems. these systems are well known in this country and ample and up-to-date literature is available. On the other hand, a detailed list of the equipment used would require several pages of description; it would amount to copying data from available literature, and still it would not render facts concerning the actual extent of the present day oil shale industry under USSR management.

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2. The following description of plant equipment is based on the German Expansion Plan. [redacted] the USSR followed this layout more or less closely with the exception of additional city gas producers. This German program was nearly completed when in September 1944 the German retreat started and most of the installations were blasted.

(a) Kohtla-Jarve Oil Shale Plant consisted of the following main production departments:

2-Underground mines
2-Crushing and screening plants
Carbonization department:

			Annual Output
Factory No 1-6 Pintsch Vertical Generators	40 tons		12,000 tons
" 2-8 " " "	40 "		16,000 "
" 3-16 " " "	40 "		32,000 "
" 4-20 " " "	40 "		40,000 "
Modified Pintsch Generator "1944"	100 "		6,000 "
Factory No 5-2 Tunnel Kilns	400 "		50,000 "
Total carbonization equipment			156,000 "

(for Pintsch Generator see Enclosure "E", and for Tunnel Kiln see Sketches "F" to "I".)
Battery or compartment kilns for city gas production
Condensing plant
Refinery
Various secondary plants
Power House and utilities system

It would be impractical to enumerate the entire equipment in detail for such a large plant, which occupied an area of about one square mile.

Comparative data for output by products for Kohtla-Jarve:
(all in metric tons per annum)

	(1939) Actual Production	(1945) German Plan
Shale mined	666,500	1,300,000
Crude oil	61,000	156,000
Gasoline	1,500	18,000

(to obtain shale minad in short tons multiply by 1.1
to obtain oil and gasoline in barrels multiply by 6.54.)

(b) Ahtme Oil Shale Plant consisted of the following main production departments:

Underground mins
Crushing and classifying plant
Drying plant
Carbonization department:

		Annual Output
Factory No 1-4 Tunnel Kilns 400 tons ea		100,000 tons
" 2-24 Modified Pintsch Generators	100 tons ea	140,000 "
Total carbonization equipment		240,000 "

(See Sketches "E" to "I")

Battery of compartment kilns for city gas production
Condensing plant
Redistillation and refrigeration plant
Refinery
Various secondary recovery plants
Asphalt blowing plant
Sulphur plant
Power House and utilities system

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Comparative data for output by products for Ahtme:

	(1945) German Plan
Shale mined	1,500,000 metric tons
Crude oil	240,000 " "
Gasoline	29,000 " "

(c) Kivioli Oil Shale Plant consisted of the following main production departments:

Underground mine
Crushing and classifying plant
Drying plant
Carbonization department:

			Annual Output
Factory No 1-2	Tunnel Kilns	250 tons ea	26,000 tons
" 2-2	" "	400 " "	44,000 "
" 3-2	" "	400 " "	50,000 "
" 4-14	Modified Pintsch Generators	100 " "	80,000 "
Total carbonization equipment			200,000 "

(See sketches "E" to "I". There is actually a construction difference between the three above-mentioned types of tunnel kilns. This is of complex technological nature, however, and can be omitted in this report.)

Condensing plant
Redistillation and refrigeration plant
Refinery
Various secondary recovery plants
Asphalt blowing plant
Power House and utilities system

Comparative data for output by products for Kivioli:
(all in metric tons)

	(1939) Actual Production	(1945) German Plan
Shale mined	510,000	1,150,000
Crude oil	70,000	200,000
Gasoline	11,500	24,000

(to obtain shale mined in short tons multiply by 1.1
to obtain oil and gasoline in barrels multiply by 6.54.)

3. In order to make this report complete [redacted] add two oil shale processing plants [redacted]

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(a) Sillamae Oil Shale Plant consisted of:

One strip mine
Crushing and classifying plant
Drying and nodulizing plant
Carbonization plant
Two Tunnel kilns system Gröndal-Ramén, annual output 42,000 metric tons
Condensing plant
Refinery
(for carbonization plant see sketch "K")

(b) Kohtla (New Consolidated Goldfields Ltd) Oil Shale Plant consisted of:

One strip and underground mine
Crushing plant
Carbonization plant

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Two batteries of four rotating kilns system Davidson, annual output 12,000 tons
Condensing plant
Refinery
Small power plant, later abandoned
(for carbonization plant see sketch "L")

4. Comparison of Output for the Entire Oil Shale Industry:
(all in metric tons per annum)

	(1939) Actual Production	(1945) German Plan	(1950) USSR Plan(s)
Shale mined	2,000,000	7,000,000	9,000,000 11,000,000
Crude oil	181,000	650,000	715,000 1,000,000
Gasoline	22,500	82,000	180,000

5. Comparison of USSR and German Plans for Oil Output only:
(all in metric tons per annum)

	USSR (1950) Version I	Version II	German (1945)
Kohtla-Jarve	172,000	210,000	156,000
Ahtme	252,000	225,000	240,000
Kivioli	237,000	200,000	200,000
Sillamae	42,000	150,000	42,000
Uhtna Kabala	-	190,000	-
Kohtla (or unknown)	12,000	25,000	12,000
Total	715,000	1,000,000	650,000

6. [redacted] In the spring of 1944 it became evident that due to wartime difficulties the German target would not be reached by 1945, and would be delayed perhaps one year. Furthermore it was obvious that maintaining a strict production schedule was almost impossible because the extraction of oil from shale is an intricate process which presupposes the availability of numerous chemical and mechanical means which were difficult to obtain in war-torn Europe. The same considerations apply to the USSR output target set for 1950, although peaceful conditions have prevailed in Estonia since 1945. [redacted] main difficulties of the USSR [redacted] clearing the plant sites from the results of the German blastings, in obtaining German-made spare parts, and in acquiring skilled personnel, tools and chemicals. [redacted]

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It can be taken as a fact that less than 700 thousand metric tons of oil were produced in 1950. On the other hand [redacted] the USSR goal will be reached during 1953 or 1954 because of the urgency of the demand and because of certain nontechnical information leaking out of Estonia [redacted] According to this, Kohtla-Jarve is now a city with a population of over 15,000, Ahtme over 5,000 and Kivioli over 4,000, the gas pipeline to Leningrad is operating, plenty of shale and shale oil is avilable for government purposes etc /1953/. [redacted] a daily output of about 6,000 to 8,000 barrels per day may have been reached by 1950 and perhaps some 10,000 barrels per day during 1952 or 1953. Besides shale, shale oil and gasoline the USSR aimed at an annual output of 15,000 tons of sulphur, 400 million cubic meters (15 billion cubic feet) of city gas, and very considerable amounts of asphalt and acetone.

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7. [redacted]

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The crude oil obtained from Estonian shale consists on the average (corresponding to the four different carbonization systems and due to the condensing process) of:

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10% heavy oil
60% medium oil
25% light oil
5% light gasoline

Depending on the steering of the refining process applied, the main products to end users are:

	Quality
Bunker oil (furnace fuel)	very good
Gasoline	good
Denaturing gasoline	very good
Diesel fuel	good
Road bitumen (asphalt)	good
Dust fixing oil for roads	very good
Roofing board tar	medium
Roofing board varnish	medium
Carbolineum (impregnating agent)	good
Fruit tree carbolineum	very good
Axle oil (low-grade lubricant)	medium
Kerosene	poor
Sulphur	99% pure
Acetone	very good
Bakelite	very good
Insecticides	good

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Depending on further treatment there were numerous products obtained from Estonian crude oil by the IG Farben Co in Germany.

Further products to end users are:

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		BTU/cu ft
Permanent (noncondenseable) gas used as fuel - heating value		129
City gas		" " 440
		BTU/lb
Raw shale grade I, classified: particle size-4	to +1 1/2 in -	" 6,300
" " " IIb "	-1 1/2 to +3/8 in	" 5,600
" " " II unclassified		" 5,200
" " " III classified: smaller than 3/8 in		" 4,500

End users for this last group of products were power stations in Estonia and Latvia, industrial plants for heating purposes, railroads and civilian sector. Briquettes were pressed of III grade shale and sold for use in ovens.

Further products were shale ashes used for slag concrete (good) and for profile bricks for building purposes (poor). There is furthermore the possibility of extraction of uranium from spent shale.

8.

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Production of various oil shale mines: (all in metric tons per annum)

Location	Actual Hauling (1940)	(1943)	German Plan (1945)
Kohtla-Jarve District:			
Mine Kava	470,000	370,000	700,000
" Kukruse	390,000	300,000	600,000
" Kohtla	77,200	54,000	65,000
" Ereda	-	-	2,000,000
Kivioli District:			
Mine Kivioli	536,000	327,000	1,150,000
" Kuttejou	165,000	173,000	145,000
" Aidu	-	-	(to start later)

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Others:			
Mine Ahtme	-	-	1,500,000
" Vivikond	227,000	34,000	350,000
" Kunda	70,000	35,000	50,000*
Total Estonia	2,000,000	1,293,000	6,560,000
Mine Slantsy	unknown	negligible	500,000
GRAND TOTAL	2,000,000	1,300,000	7,060,000

(*Mine Kunda did not belong to Oil Shale Industry and was therefore not included in the German Plan.)

(To obtain mined shale in short tons multiply above figures by 1.1.)

The total amount of hauled shale from the foundation of the oil industry in 1918 up to August 1944 was 19.5 million short tons.

9. [redacted] 50X1-HUM

The mines Vivikond and Kundawere strip mines, Kuttejou and Kohtla were partially strip, and partially underground mines. All remaining Estonian mines were underground mines about 10 to 40 feet below surface. The USSR mine of Slantsy was an underground mine about 200 feet below surface. To my recollection the main difficulties were to keep the subsoil water out of the mine, the application of the right bits for drills, and the separation of the oil shale from the surrounding limestone. One additional problem of the USSR is apparently to maintain or increase the efficiency of the individual miner. This problem was solved during the Estonian era by means of very good piece wages per amount of shale hauled; successful miners were the highest paid employees of the entire industry.

10. [redacted] 50X1-HUM

The shale banks are drilled, explosives inserted, blasted, shale sorted manually from limestone. Limestone used for backfilling the mined area, building piles to support the ceiling and sometimes for building purposes above surface. The shale is loaded manually into cars. All these operations were the most time-consuming of the entire process. Drilling was done by compressed air or increasingly by using electrical drills. Beginning about 1938 there was increasing mechanization of the mines. Reaming and loading machines were used. The attempt to do the sorting mechanically failed due to the similarity of color and specific gravity of shale and limestone. Picking conveyors were installed to facilitate separation. From the place of mining to the elevators or to the surface crusher plants, the shale was transported by electrical railroads or diesel engines. Since no explosive gases are present in Estonian oil shale mining, no precautions were necessary to prevent disaster. The mines were electrically lighted and ventilated. Substations with rectifiers for railroads were usually installed below surface. Some plants had crusher and classifier equipment at the mine, others at the carbonization plant site.

11. [redacted] 50X1-HUM

At first all locomotives of the state railroads were fired with oil shale, using first-grade shale and larger lumps up to 12 by 20 inches. These furnaces were provided with movable, elliptical grate bars and were operated by hand. The amount of shale used for locomotives reached its peak in the late twenties with about 200 thousand metric tons per year, later on it decreased to about half this amount. With the development of shale oil production passenger locomotives were converted to oil, but most freight locomotives were still fired with oil shale. It is possible that the consumption of raw shale has increased since the latest USSR occupation of Estonia.

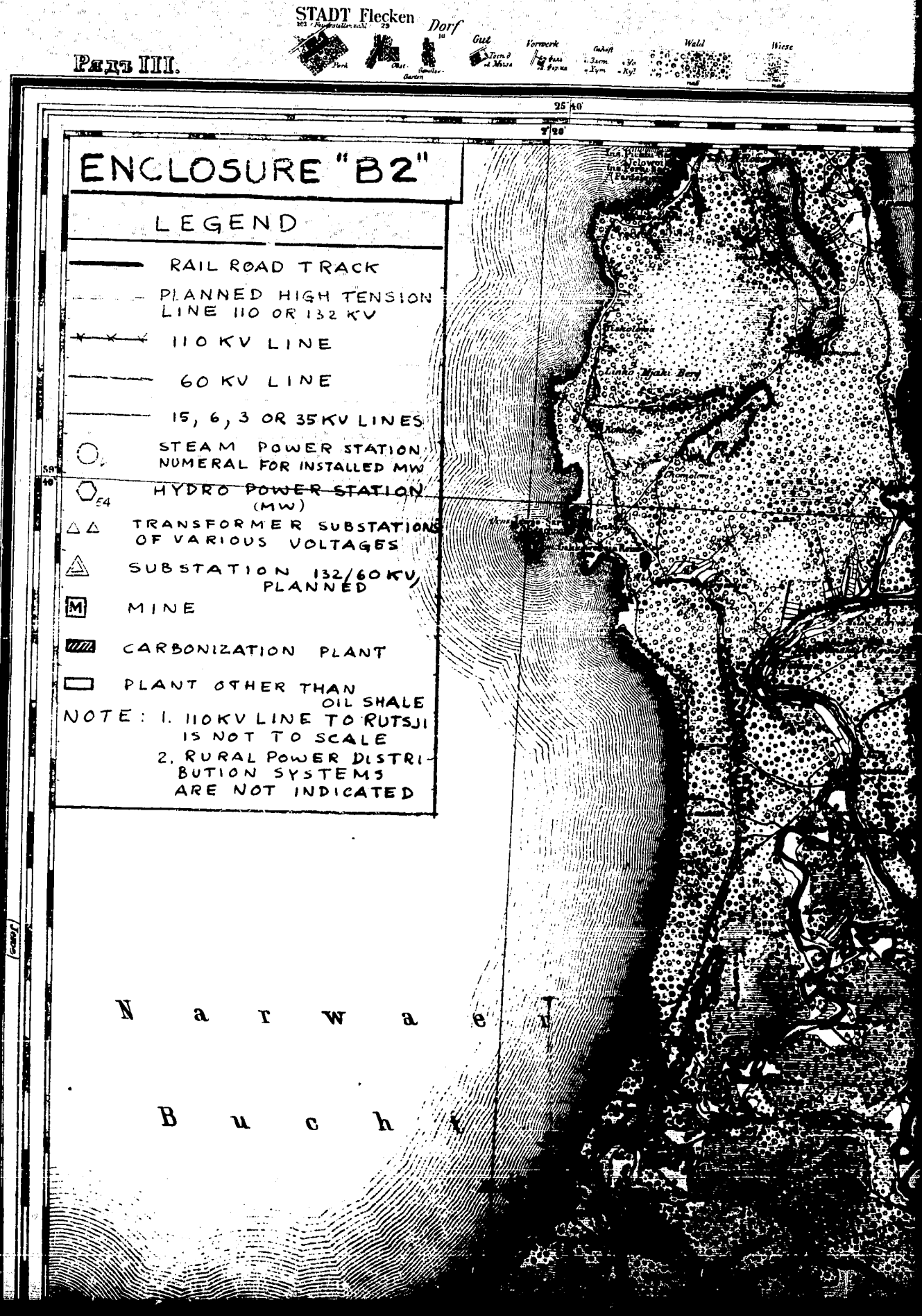
[redacted] 50X1-HUM

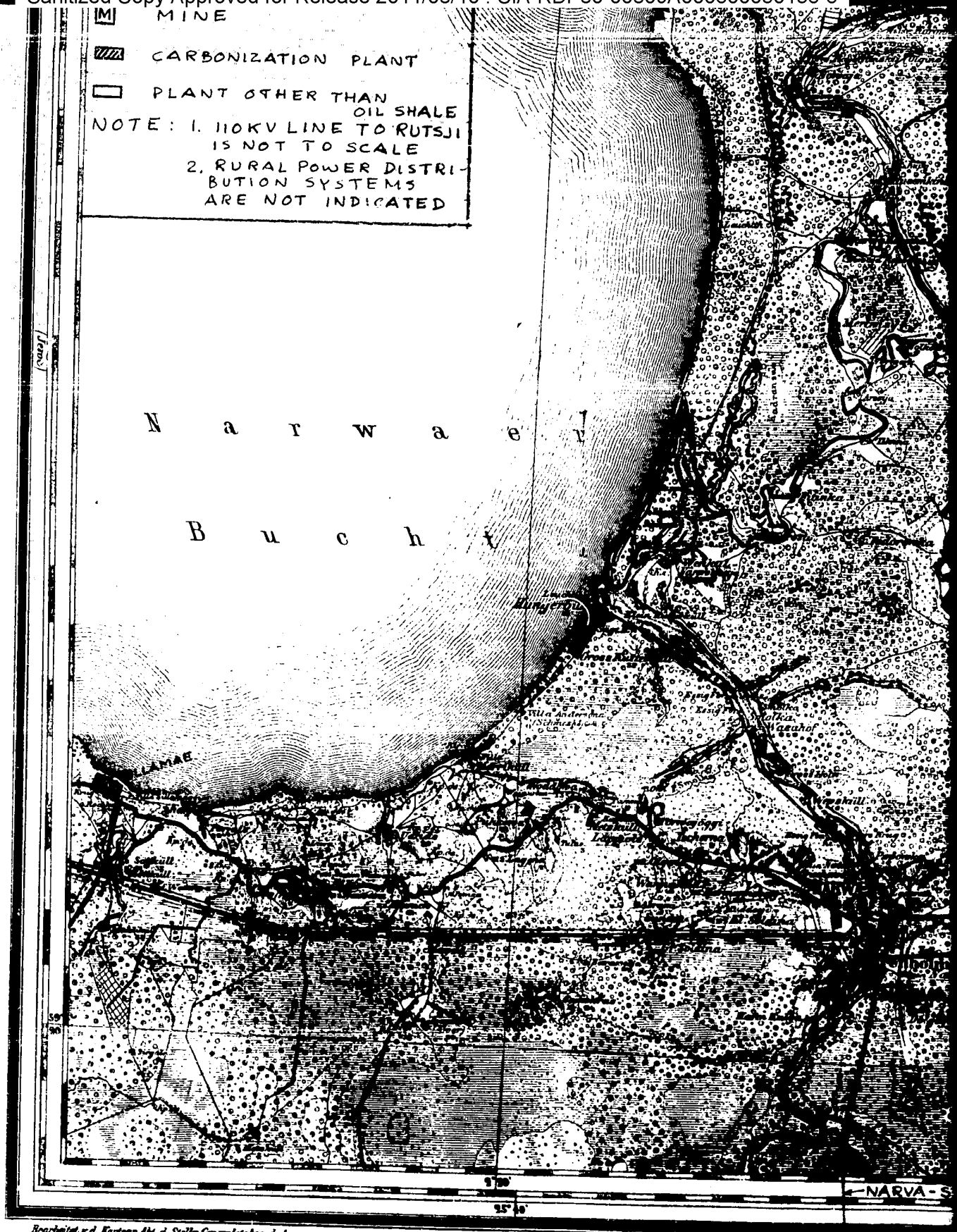
[redacted] a map (Encl "B1" and "B2") of northeastern Estonia showing power distribution of the oil shale industry, location of mines, carbonization plants and power stations. (This is an old Russian General Staff map overprinted by the German General Staff in 1915 with [redacted] marks concerning oil shale facilities.) 50X1-HUM

[redacted] the following documents: "E": [redacted]: Kohtla-Jarve Static Vertical Retort - corresponds to the 40 tons/day Pintsch Vertical Generator. [redacted] Comment: The modification "1944" is basically similar only much larger. "F": Kivioli Tunnel Kiln. "G": Kivioli Tunnel Kiln Temperature Gradient Chart. "H": Kivioli Carbonization Plant, Fractional Condensing Plant. "I": Kivioli Carbonization Plant, Light Spirits Recovery Plant. "K": Gröndal-Remèn Tunnel Kiln; Section and plan view of carbonization unit applied at Sillamae. "L": Davidson Rotary Retort; Section of carbonization unit applied at Kohtla (formerly the New Consolidated Goldfields Ltd). 50X1-HUM

-end-

[redacted] 50X1-HUM





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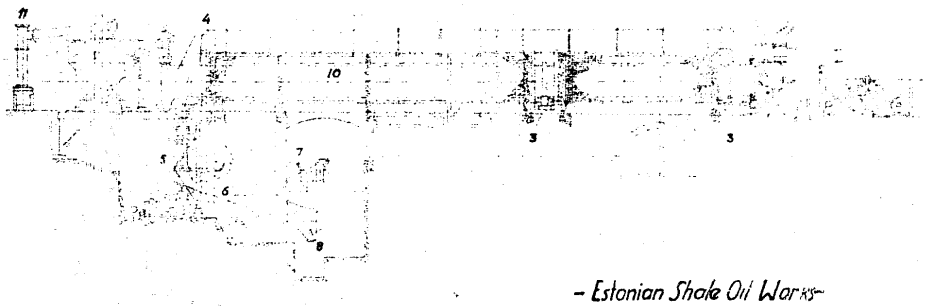
Hohenzahlen (liegend) in Sachen a. d. Meter

Eisenbahn, Chaussee mit und ohne Bäume, Feldstrasse mit und ohne Bäume,

The Davidson Rotary Retort.

Longitudinal Section of Retort.

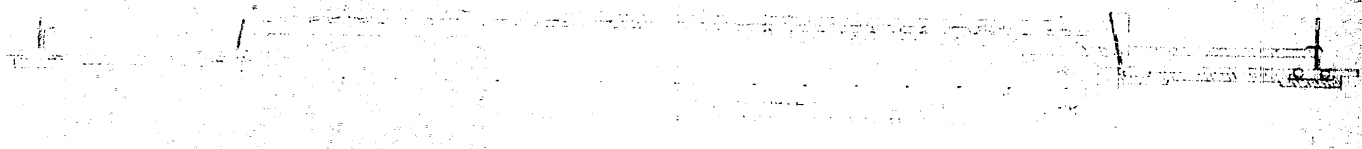


– Estonian Shale Oil Works –

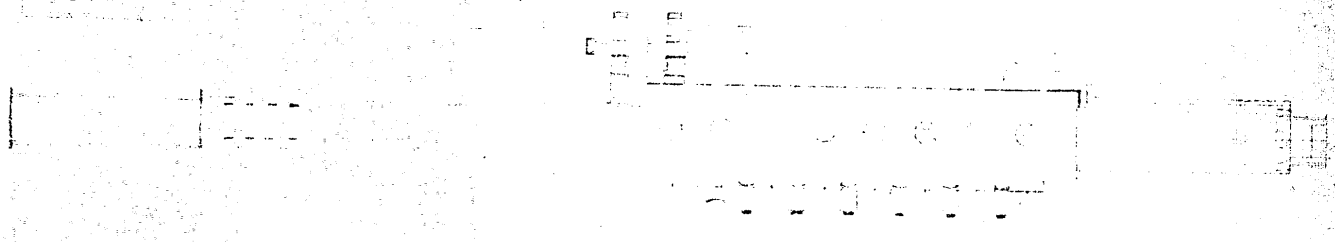
ENCLOSURE "L"

The Gröndal - Ramén Tunnel-Oven.

Longitudinal Section of Tunnel.

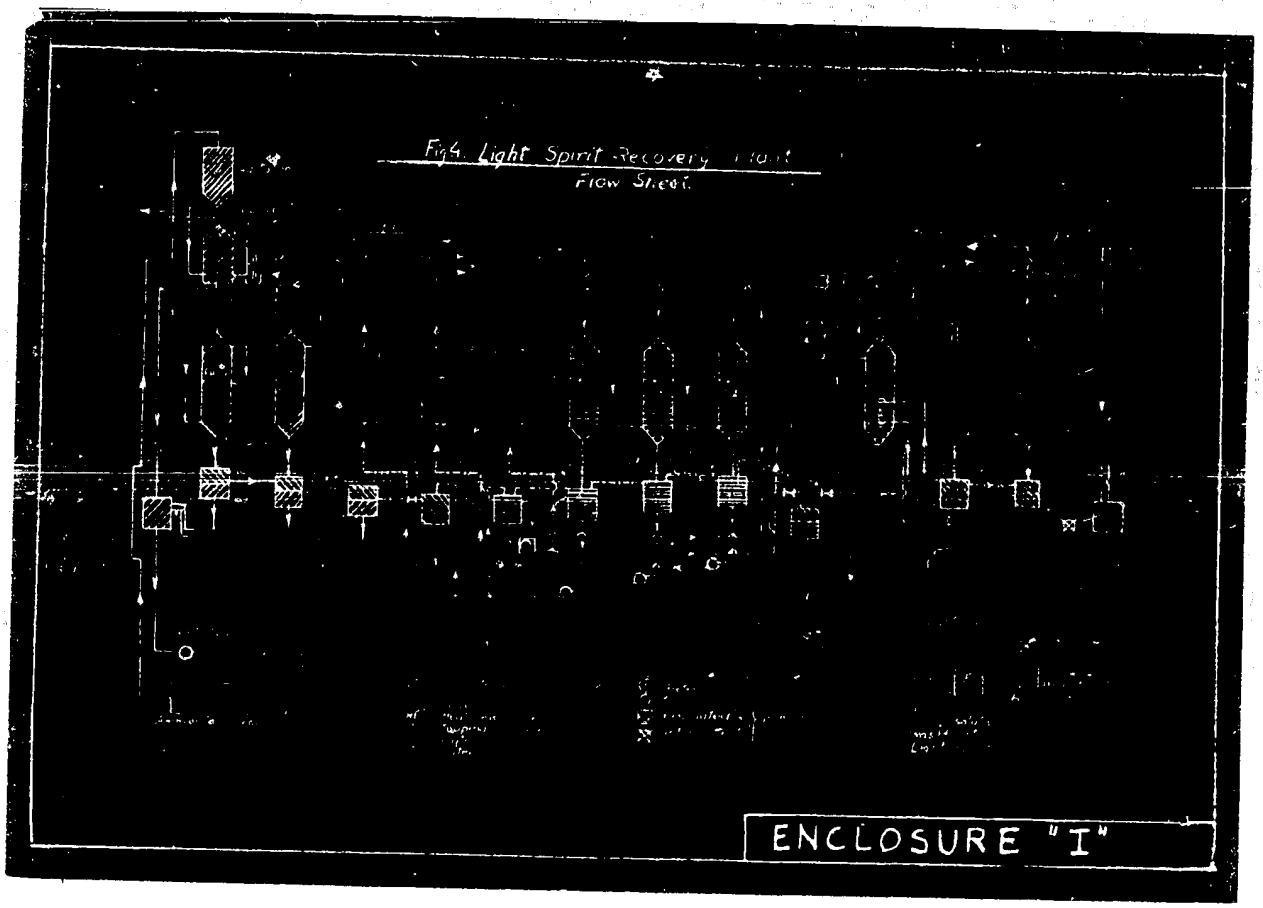


Plan of the Tunnel-Oven.



- Estonian Shale Oil Works --

ENCLOSURE "K"



Estonian Shale Oil Works

ENCLOSURE "H"

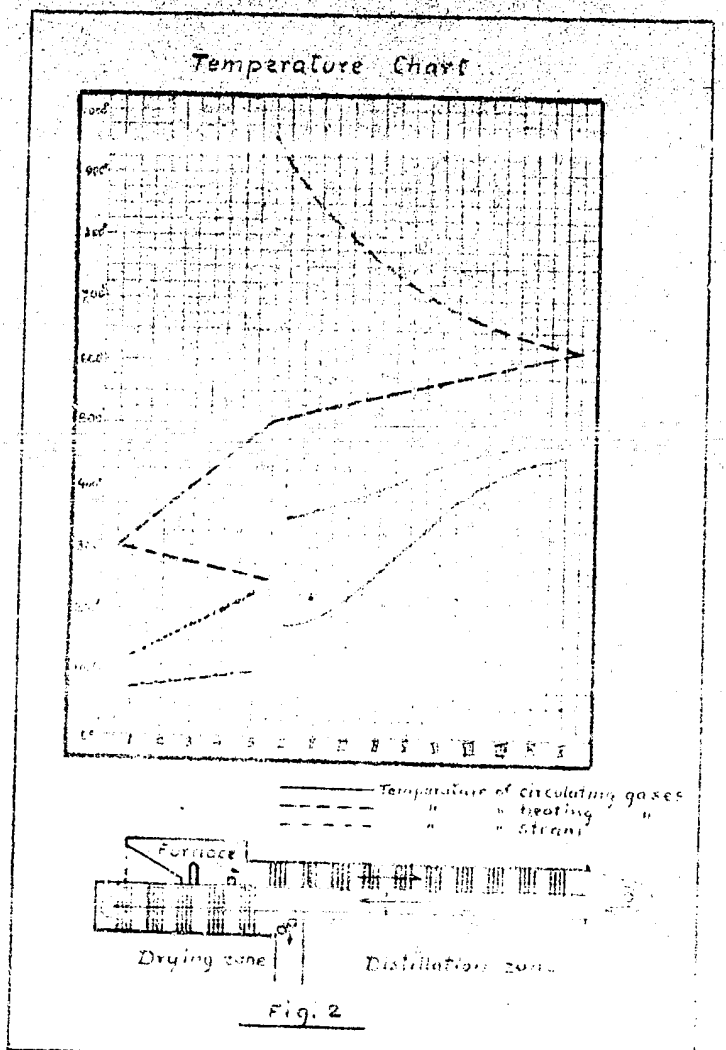
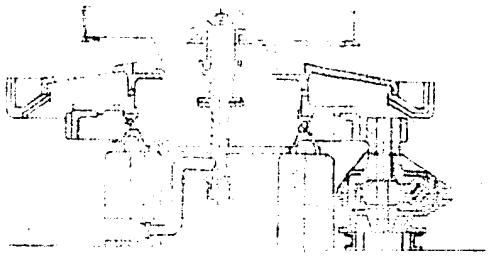


Fig. 2

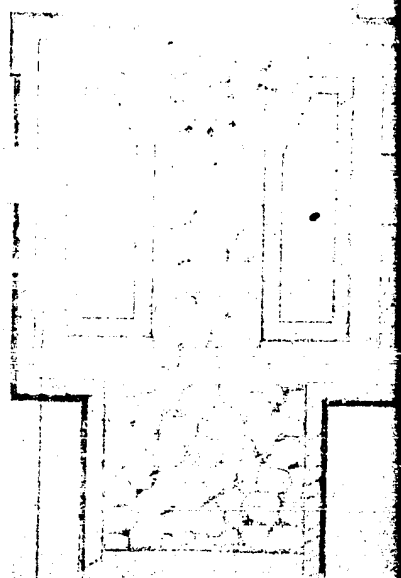
Estonian Shale Oil Works
"Eesti Kiviõli" Ltd.

ENCLOSURE "G"

The "Kohtla - Järve" Static Vertical Retort.

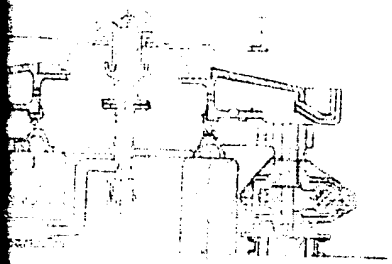


Cross section of cylindershaped retort.

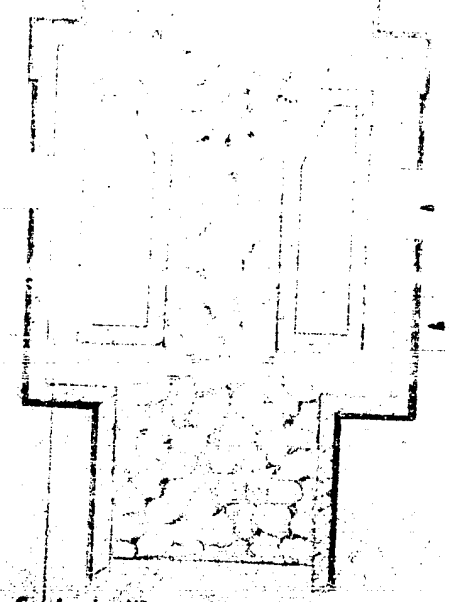


Scheme of retort with conical narrowne

The "Kohtla - Järve" Static Vertical Retort.



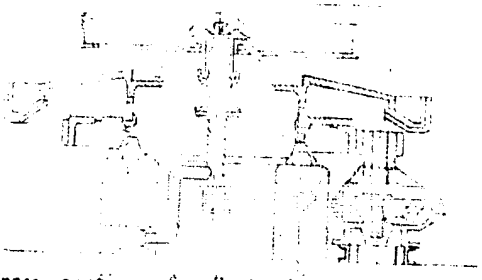
...on of cylindershaped retort.



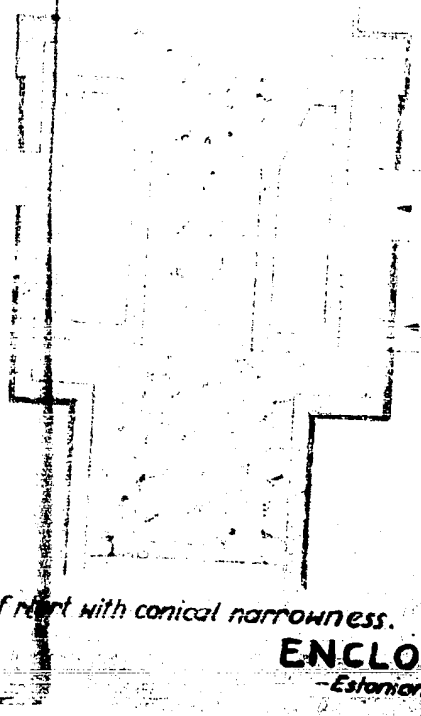
Scheme of retort with conical narrowness.

ENCLOSURE "E"
-Estonian Shale Oil Works-

The "Kohtla - Järve" Static Vertical Retort.



Cross section of cylindershaped retort.



Scheme of retort with conical narrowness.

ENCLO
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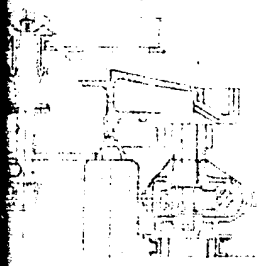
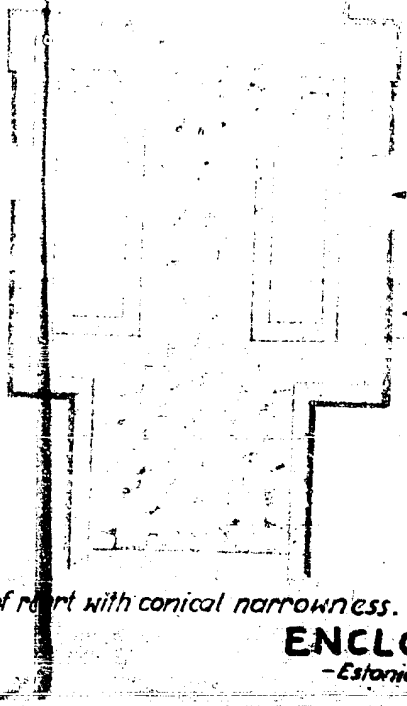
he "Kohtla - Järve" Static Vertical Retort.

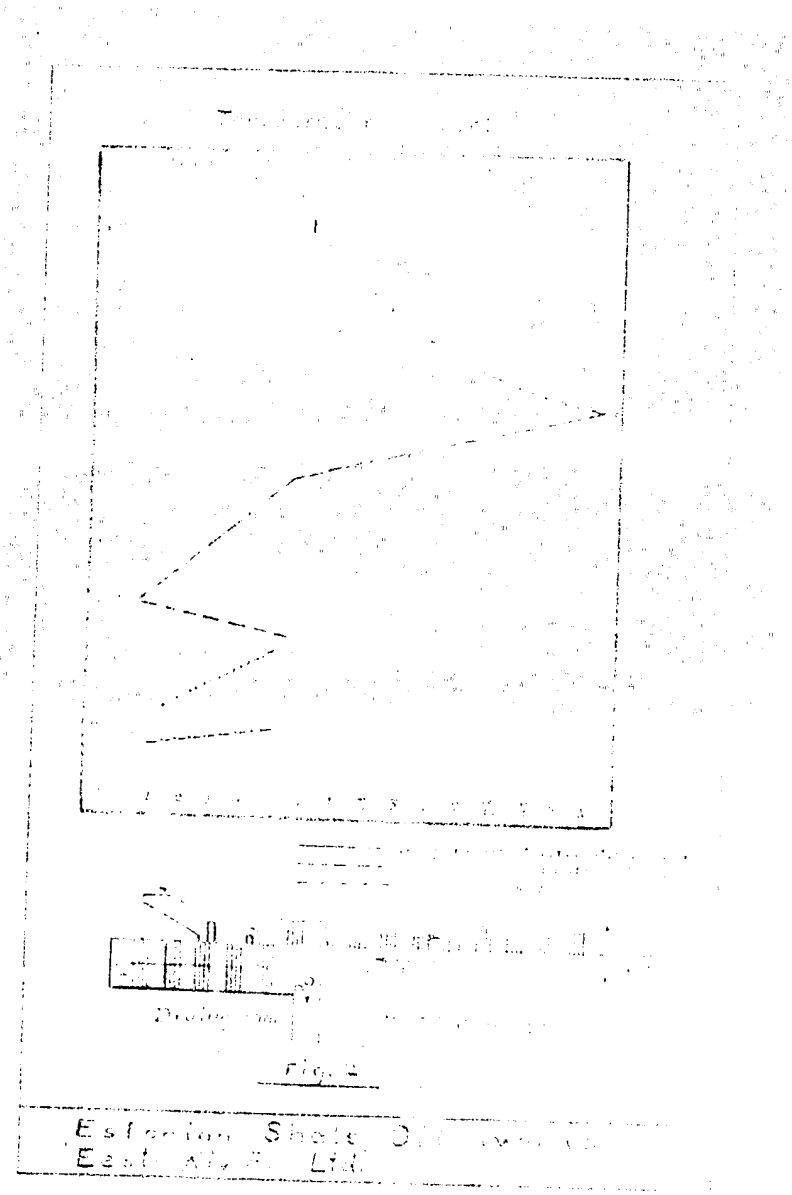


ylindershaped retort.



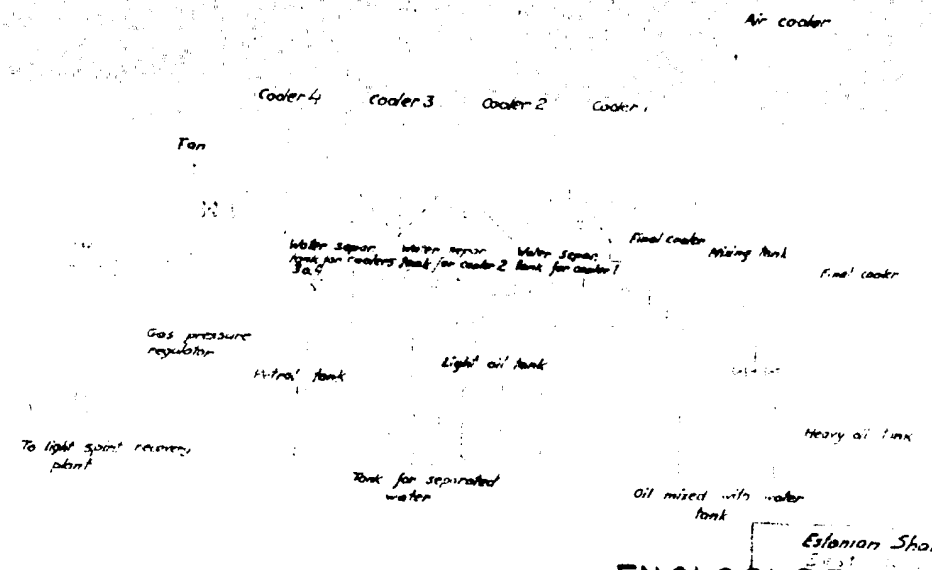
Scheme of retort with conical narrowness.

ENCLOSURE "E"
-Estonian Shale Oil Works-



ENCLOSURE "G"

Fig. 5 Condensing (Fractional) Plant.

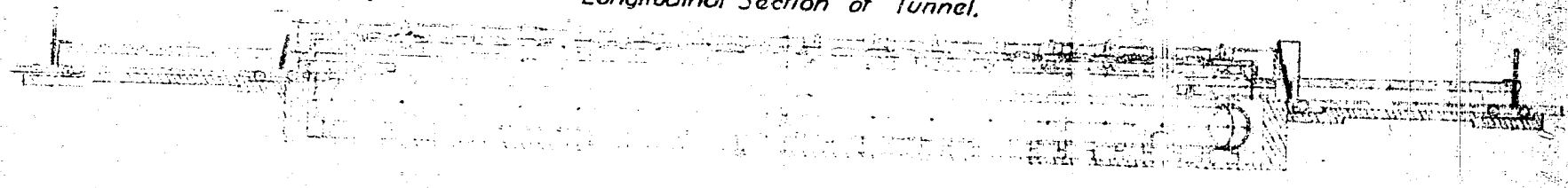


Estonian Shale Oil Works

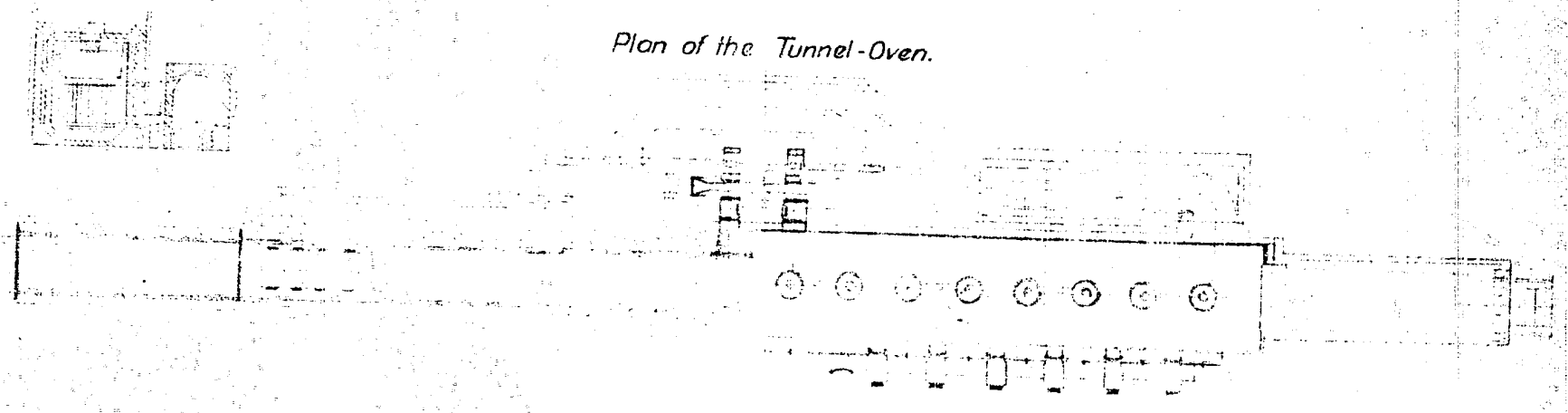
ENCLOSURE "H"

The Gröndal-Ramén Tunnel-Oven.

Longitudinal Section of Tunnel.



Plan of the Tunnel-Oven.

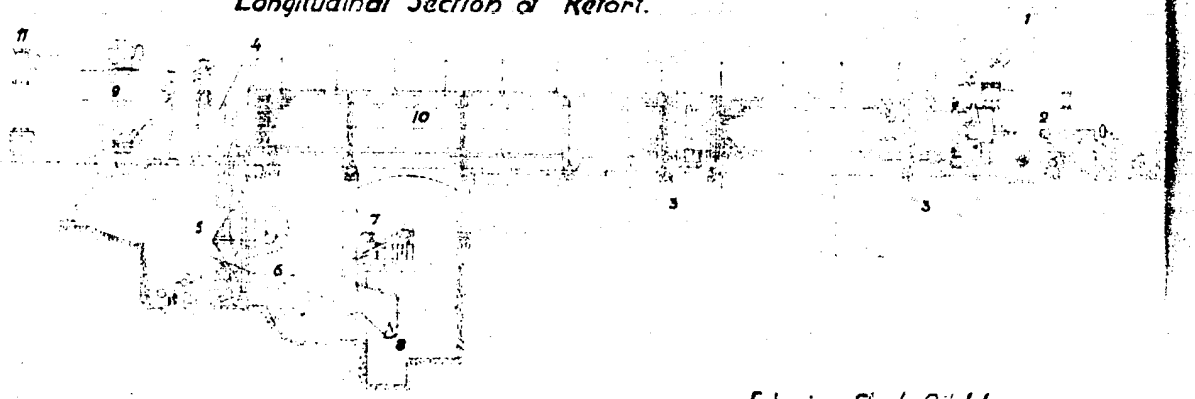


-Estonian Shale Oil Works-

ENCLOSURE "K"

The Davidson Rotary Retort

Longitudinal Section of Retort.



- Estonian Shale Oil Works -

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